

What Can You Do?

High-Altitude “Good” Ozone

- Make sure that technicians working on your car air conditioner, home air conditioner, or refrigerator are certified by an EPA approved program to recover the refrigerant (this is required by law).
- Have your car and home air conditioner units and refrigerator checked for leaks. When possible, repair leaky air conditioning units before refilling them.
- Contact local authorities to properly dispose of refrigeration or air conditioning equipment.
- Protect yourself against sunburn. Minimize sun exposure during midday hours (10 am to 4 pm). Wear sunglasses, a hat with a wide brim, and protective clothing with a tight weave. Use a broad spectrum sunscreen with a sun protection factor (SPF) of at least 15 and 30 is better.

Ground-Level “Bad” Ozone

- Keep your automobile well tuned and maintained.
- Carpool, use mass transit, walk, bicycle, and/or reduce driving, especially on hot summer days.
- Be careful not to spill gasoline when filling up your car or gasoline-powered lawn and garden equipment. During the summer, fill your gas tank during the cooler evening hours.
- Make sure your car’s tires are properly inflated and your wheels are aligned.
- Participate in your local utility’s energy conservation programs.
- Seal containers of household cleaners, workshop chemicals and solvents, and garden chemicals to prevent VOC from evaporating into the air. Dispose of them properly.

We live with ozone every day. It can protect life on earth or harm it, but we have the power to influence ozone’s impact by the way we live.

For more information, contact the following EPA Offices:

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U.S. EPA Region 8

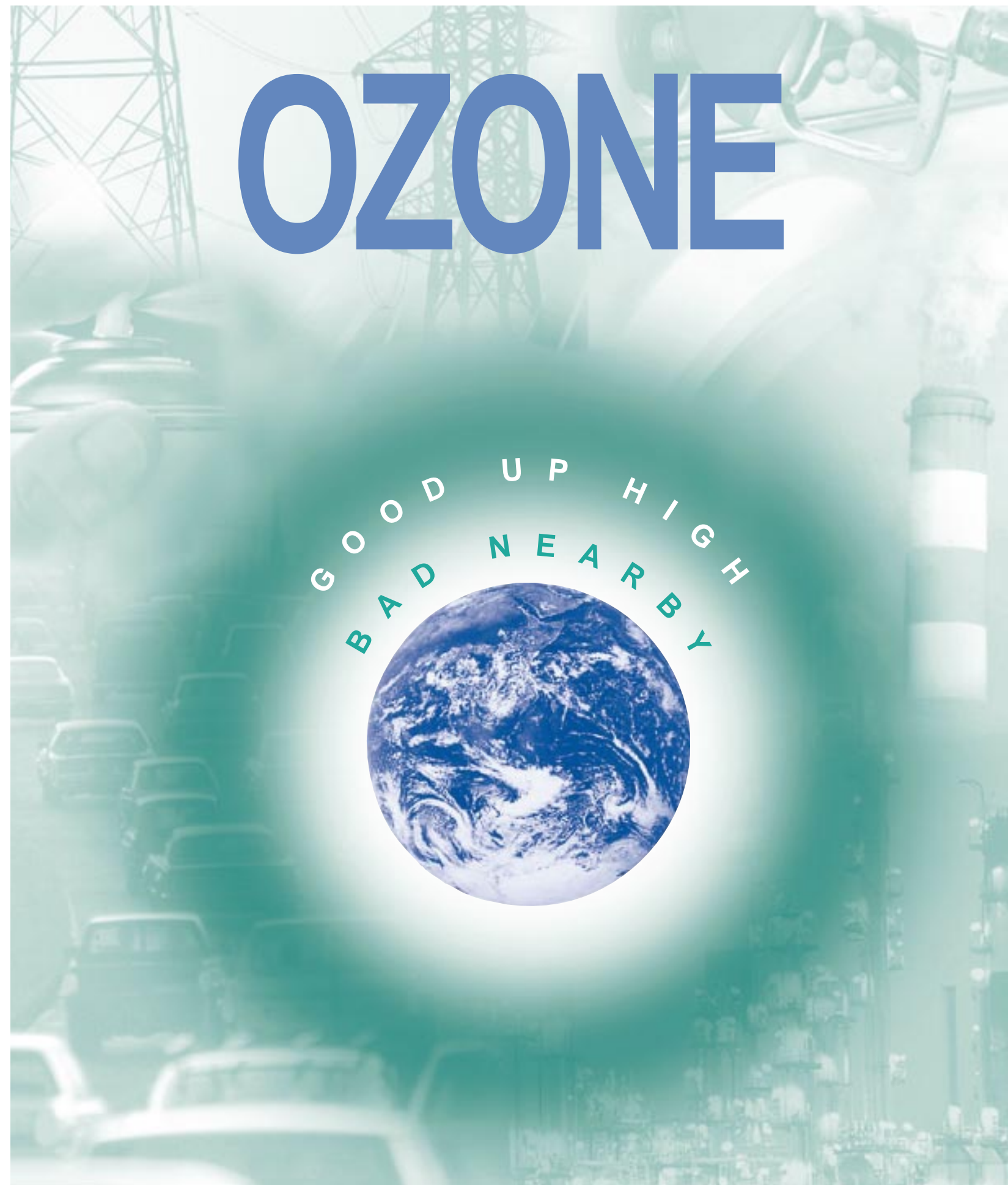
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For more information visit EPA’s website  
at <http://www.epa.gov/oar>

## What is Ozone?

Ozone is a gas that forms in the atmosphere when 3 atoms of oxygen are combined ( $O_3$ ). It is not emitted directly into the air, but at ground level is created by a chemical reaction between oxides of nitrogen ( $NO_x$ ), and volatile organic compounds (VOC) in the presence of sunlight. Ozone has the same chemical structure whether it occurs high above the earth or at ground level and can be “good” or “bad,” depending on its location in the atmosphere.

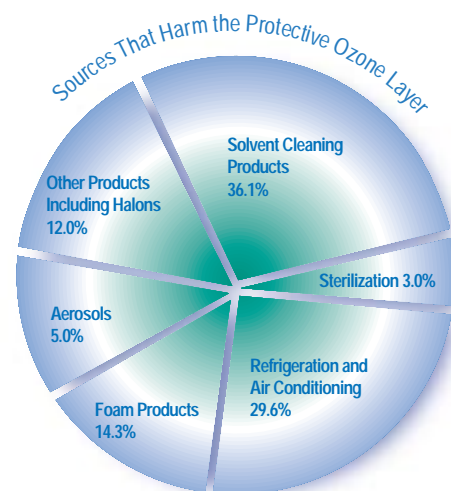
## How Can Ozone Be Both Good and Bad?

Ozone occurs in two layers of the atmosphere. The layer surrounding the earth's surface is the troposphere. Here, ground-level or “bad” ozone is an air pollutant that damages human health, vegetation, and many common materials. It is a key ingredient of urban smog. The troposphere extends to a level about 10 miles up, where it meets the second layer, the stratosphere. The

stratospheric or “good” ozone layer extends upward from about 10 to 30 miles and protects life on earth from the sun's harmful ultraviolet rays (UV-b).

## What is Happening to the “Good” Ozone Layer?

Ozone occurs naturally in the stratosphere and is produced and destroyed at a constant rate. But this “good” ozone is gradually being destroyed by manmade chemicals called chlorofluorocarbons (CFCs), halons, and other ozone depleting substances (used in coolants, foaming agents, fire extinguishers, solvents, and aerosol propellants). These ozone depleting substances degrade slowly and can remain intact for many years as they move through the troposphere until they reach the stratosphere. There they are broken down by the intensity of the sun's ultraviolet rays and release chlorine and bromine molecules, which destroy “good” ozone. One chlorine or bromine molecule can destroy 100,000 ozone molecules, causing ozone to disappear much faster than nature can replace it.



It can take years for ozone depleting chemicals to reach the stratosphere, and even though we have reduced or eliminated the use of many CFCs, their impact from years past is just starting to affect the ozone layer. Substances released into the air today will contribute to ozone destruction well into the future.

Satellite observations indicate a worldwide thinning of the protective ozone layer. The most noticeable losses occur over the North and South Poles because ozone depletion accelerates in extremely cold weather conditions.

## How Does the Depletion of “Good” Ozone Affect Human Health and the Environment?

As the stratospheric ozone layer is depleted, higher UV-b levels reach the earth's surface. Increased UV-b can lead to more cases of skin cancer, cataracts, and impaired immune systems. Damage to UV-b sensitive crops, such as soybeans, reduces yield. High altitude ozone depletion is suspected to cause decreases in phytoplankton, a plant that grows in the ocean. Phytoplankton is an important link in the marine food chain and, therefore, food populations could decline. Because plants “breathe in” carbon dioxide and “breathe out” oxygen, carbon dioxide levels in the air could also increase. Increased UV-b radiation can be instrumental in forming more ground-level or “bad” ozone.

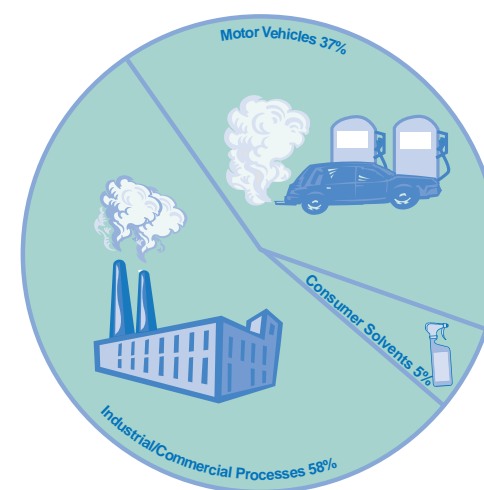
## What is Being Done About the Depletion of Good Ozone?

The Montreal Protocol, a series of international agreements on the reduction and eventual elimination of production and use of ozone depleting substances, became effective in 1989. Currently, 160 countries participate in the Protocol. Efforts will result in recovery of the ozone layer in about 50 years.

In the United States, the U.S. Environmental Protection Agency (EPA) continues to establish regulations to phase out these chemicals. The Clean Air Act requires warning labels on all products containing CFCs or similar substances, prohibits nonessential ozone depleting products, and prohibits the release of refrigerants used in car and home air conditioning units and appliances into the air.

## What Causes “Bad” Ozone?

Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents are some of the major sources of  $NO_x$  and VOC, also known as ozone precursors. Strong



Sources of VOC

sunlight and hot weather cause ground-level ozone to form in harmful concentrations in the air. Many urban areas tend to have high levels of “bad” ozone, but other areas are also subject to high ozone levels as winds carry  $NO_x$  emissions hundreds of miles away from their original sources.

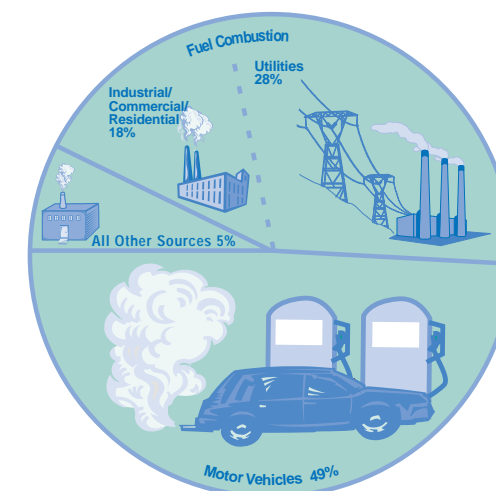
Ozone concentrations can vary from year to year. Changing weather patterns (especially the number of hot, sunny days), periods of air stagnation, and other factors that contribute to ozone formation make long-term predictions difficult.

## How Does “Bad” Ozone Affect Human Health and the Environment?

Repeated exposure to ozone pollution may cause permanent damage to the lungs. Even when ozone is present in low levels, inhaling it triggers a variety of health problems including chest pains, coughing, nausea, throat irritation, and congestion. It also can worsen bronchitis, heart disease, emphysema, and asthma, and reduce lung capacity.

Healthy people also experience difficulty in breathing when exposed to ozone pollution. Because ozone pollution usually forms in hot weather, anyone who spends time outdoors in the summer may be affected, particularly children, the elderly, outdoor workers and people exercising. Millions of Americans live in areas where the national ozone health standards are exceeded.

Ground-level ozone damages plant life and is responsible for 500 million dollars in reduced crop production in the United States each year. It interferes with the ability of plants to produce and store food, making them more susceptible to disease, insects, other pollutants, and



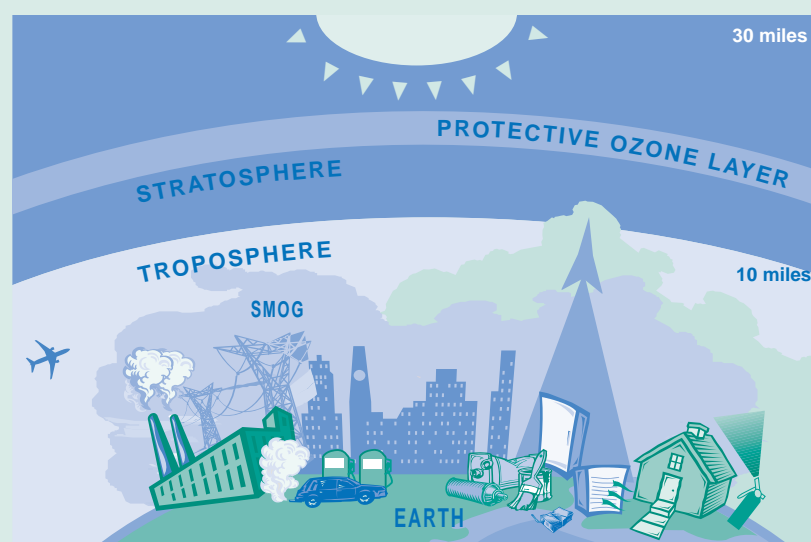
Sources of NOx

harsh weather. “Bad” ozone damages the foliage of trees and other plants, ruining the landscape of cities, national parks and forests, and recreation areas.

## What is Being Done About Bad Ozone?

The Clean Air Act Amendments of 1990 require EPA, states, and cities to implement programs to further reduce emissions of ozone precursors from sources such as cars, fuels, industrial facilities, power plants, and consumer/commercial products. Power plants will be reducing emissions, cleaner cars and fuels are being developed, many gas stations are using special nozzles at the pumps to recapture gasoline vapors, and vehicle inspection programs are being improved to reduce emissions.

The ultimate responsibility for our environment is our own. Minor lifestyle changes can result in major air quality improvements.



Too much here... Cars, trucks, power plants and factories all emit air pollution that forms ground-level ozone or smog.

Too little there... Many popular consumer products like air conditioners and refrigerators involve CFCs or halons during either manufacture or use. These chemicals damage the earth's protective ozone layer.